REMARKS

Enclosed please find a Statement from the Assignee regarding addition of Associate Practitioner in this case.

Status of Claims

Upon entry of this amendment, Claims 1-5 and 7-18 are pending in the instant application; of which Claims 1-3, 5, 7, 8 and 10 are currently being amended, and Claims 12-18 are being added. Claim 6 is being cancelled.

The amendments to the claims and the added claims are fully supported by the Specification, Claims as originally filed, and Drawings. No new matter is being added. For example, the amendments to Claims 1 and 8 are to cosmetically clarify the claim language and are supported by paragraphs 26 and 27 of the Specification. Entry of the amendments is respectfully requested. As another example, added Claim 12 is supported by original claim 1 and the Specification on page 4 lines 5-7; and page 9, line 27 to page 10, line 1. Thus, entry of the claims is respectfully requested.

Cancelled Claim 6

Due to a typographical error, there was no Claim 6 presented in the originally filed patent application. To preserve the original numbering of the claims, we are hereby canceling Claim 6, the content of which never existed.

Rejection of Claims 1-11 under 35 USC 103(a)

The Examiner rejected Claims 1-11 under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,407,399 to Livesay in view of U.S. Patent No. 5,302,238 to Roe et al. This rejection is respectfully traversed.

Claim 1

Claim 1 is patentable over Livesay in view of Roe et al. because neither of these references teach or suggest an electron beam treatment apparatus comprising, inter alia, "a cathode having an exposed surface capable of producing electrons; and an anode having holes, the anode spaced apart from the cathode by a working distance that is greater than a mean free path of the electrons produced by the cathode... wherein values of the cathode voltage, gas pressure in the chamber, and working distance are such that there is no arcing between the cathode and anode at the working distance that is greater than the mean free path of the electrons from the cathode."

Livesay teaches against an apparatus in which the working distance between the anode and the cathode that is greater than an electron mean free path of electrons produced by the cathode. Livesay discloses an electron emission apparatus having an anode spaced apart from a cathode. Livesay further discloses the anode is "preferably placed at a distance [from the cathode] less than the mean free path of the electrons emitted by the cathode" (column 6, lines 3-4). Thus, the preferred embodiment taught by Livesay teaches against the apparatus of Claim 1. While the Examiner acknowledges that Livesay fails to show that the working distance is greater than an electron mean free path, the Examiner also should not suggest insertion of a teaching contrary to the teachings of the reference to support a *prima facie* obviousness rejection.

Furthermore, Roe et al. does not make up for the deficiencies of Livesay, nor does Roe et al. provide reasons to contradict the preferred embodiment of Livesay. Instead, Roe et al. discloses a field emission display apparatus and a plasma dry etching process for forming cathode emitter tips of the field emission display apparatus. The cathode emitter tips are etched from a substrate comprising silicon and each have a conical shape with a peak near an opening in an anode gate structure surrounding the cathode emitter tip. However, Roe et al. also does not teach or suggest having an anode spaced apart from the cathode by a working distance greater than the mean free path of electrons emitted from the cathode as recited in claim 1.

The Examiner states that Roe et al. teaches such a limitation of a working

distance greater than the mean free path of electrons emitted from the cathode. However, Roe et al. does not teach such a limitation. Roe et al. only discusses the mean free path of ions in a plasma present during an etching process used to form the cathode emitter

tips. Specifically, Roe et al. recites in column 5 lines 4-16 (emphasis added below):

> While the invention is presently in the developmental stage, it is anticipated that the inventive process will include a low pressure atmosphere in order to produce a faster oxide etch rate. Low pressure allows for more ion bombardment because of the longer mean free path that the ions have before colliding with the surface, or other ions. When combined with high radio frequency (RF) power, the etch rate is increased. Low pressure and RF power do have drawbacks, however. Although RF induced ion bombardment assists in oxide etch, it also contributes to photoresist erosion, which is undesirable. Further, if RF power is too high, the resist will "burn" or reticulate.

Thus, Roe et al. discloses an oxide etch to form the cathode emitter tips which is conducted at a low pressure to increase the ion bombardment (and thus etch rate) because of the longer mean free path of the plasma ions at a lower pressure. Roe et al. does not teach or suggest the mean free path of electrons emitted from the cathode during operation of the field emission display apparatus. Roe et al. only discusses the mean free path of plasma ions during the fabrication of the field emission display apparatus and not the mean free path of electrons during the operation of the field emission display apparatus.

The section of Roe et al. cited by the Examiner recites in column 5, lines 42-55 (emphasis added below):

> The primary means of controlling the height to width ratio of the tip 13 formed by the process of the present invention is through the combination of halide containing gases. However, by making use of the temperature dependence of the evaporation rate of the etch products in combination with the increased removal rate of the etch products in a directional way (due to the directional nature of plasma created ions "sputtering" off the etch product). One may control the height to width ratio of the tip 13 by controlling the temperature and/or the impact energy of the ions in the plasma. Ion impact energy is increased by raising the RF power or lowering the process pressure (this increases the mean free path as described above).

Thus, Roe et al. discloses controlling the height to width ratio of the emitter tips formed by the plasma etch process by controlling the impact energy of the ions in the plasma during the etching process by lowering the process pressure which increases the mean free path of the plasma ions. Thus, in the section cited by the Examiner, Roe et al. does not teach or suggest the desirable spacing of anode and cathode relative to mean free path of electrons emitted by the cathode during operation of the field emission display apparatus, but rather discloses modifying the mean free path of plasma ions in an etching process used to fabricate the cathode emitter tips. In fact, Roe et al. is silent in regard to the mean free path of electrons emitted from the cathode emitter tips. Furthermore, Roe et al. is

silent in regard to the distance between the cathode emitter tip and the anode gate.

Thus, the electron beam treatment apparatus of claim 1 is not obvious over the combination of Livesay and Roe et al. Neither Livesay nor Roe et al. teaches or suggests an anode spaced apart from a cathode by a working distance greater than the mean free path of an electron emitted by the cathode. Livesay teaches against a working distance between the cathode and anode greater than the mean free path of an electron, as discussed above, and Roe et al. is silent in regard to the working distance between the cathode and anode and also in regard to the mean free path of an electron. Thus, Claim 1 and those claims dependent therefrom are patentable over Livesay in view of Roe et al.

Claim 8

Claim 8 is patentable over Livesay in view of Roe et al. because neither of these references teaches or suggests a method of treating a wafer with an electron beam comprising, inter alia, maintaining a working distance between the anode and the cathode that is greater than an electron mean free path of electrons produced by the cathode; and setting the source of negative voltage, the gas introduction rate, the gas exhaust rate, and the working distance to provide values of cathode voltage, gas pressure, and working distance such that there is no arcing between the cathode and anode at the working distance that is greater than the mean free path of electrons from the cathode.

As acknowledged by the Examiner, Livesay does not teach maintaining a working distance between the anode and the cathode that is greater than an electron mean free path of electrons produced by the cathode. However, more importantly, Livesay teaches against maintaining a working distance between the anode and the cathode that is greater than an electron mean free path of electrons produced by the cathode. Instead, Livesay discloses a method of producing an electron beam emission from an electron emission apparatus having an anode spaced apart from a cathode and "preferably placed at a distance [from the cathode] less than the mean free path of the electrons emitted by the cathode" (column 6, lines 3-4). Thus, the preferred embodiment taught by Livesay teaches against the method of treating a wafer of Claim 8.

Roe et al. fails to make up for the deficiencies of Livesay. Roe et al. discloses a plasma dry etching process for forming cathode emitter tips of a field emission display apparatus. The cathode emitter tips are etched from a substrate comprising silicon and each have a conical shape with a peak near an opening in an anode gate structure surrounding the cathode emitter tip. However, this does not make up for the deficiencies of Livesay because Roe et al. also does not teach or suggest maintaining a working distance between the anode and the cathode that is greater than an electron mean free path of electrons produced by the cathode, as claimed in claim 8. Instead, Livesay is silent with regard to setting the spacing between the cathode emitter tips and the anode gate structure.

The Examiner states that Roe et al. teaches such a limitation of a working distance greater than the mean free path of electrons emitted from the cathode. However, Roe et al. does not teach such a limitation. Roe et al. only discusses the mean free path of ions in a plasma present during an etching process used to form the cathode emitter tips. Roe et al. discloses an oxide etch to form the cathode emitter tips which is conducted at a low pressure to increase the ion bombardment (and thus etch rate) because of the longer mean free path of the plasma ions at a lower pressure. Roe et al. also discloses controlling the height to width ratio of the emitter tips formed by the plasma etch process by controlling the impact energy of the ions in the plasma during the etching process by lowering the process pressure which increases the mean free path of the plasma ions. However, Roe et al. does not teach or suggest the mean free path of electrons emitted from the cathode but only discusses the mean free path of plasma ions. Furthermore, Roe et al. is silent in regard to the distance between the cathode emitter tip and the anode gate.

Thus, the method of operating the electron beam treatment apparatus of claim 8 is not obvious over the combination of Livesay and Roe et al. Nor does such the cited combination provide a *prima facie* obviousness rejection, since one of ordinary skill in the art would neither be motivated to go against the teachings of the primary reference nor substitute the non-teachings of the secondary reference. Livesay teaches against spacing the anode apart from the cathode by a working distance greater than the mean free path

of an electron, and Roe et al. is silent in regard to setting the working distance between the cathode and anode. Thus, Claim 8 and those claims dependent therefrom are patentable over Livesay in view of Roe et al.

Claims 12-18

Claims 12-18 are also patentable over the cited references because the cited references do not teach an electron beam treatment apparatus comprising a chamber including, inter alia, a cathode having an exposed surface area of from about 4 square inches to about 700 square inches; an anode spaced apart from the cathode by a working distance in a range of from 10 to 30 mm; a source of negative voltage whose output is applied to the cathode to provide a cathode voltage; and a source of voltage whose output is applied to the anode. Thus, claims 12-18 should also be allowable.

CONCLUSION

For the foregoing reasons, allowance of the instant application is respectfully requested. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES, P.C.

Date: November 1, 2004 By: _____

Ashok K. Janah
Reg. No. 37,487

Please direct telephone calls to: Ashok K. Janah, (415) 538-1555

Please continue to send all correspondence to:
Patent Department, M/S 2061
APPLIED MATERIALS, INC.
P.O. Box 450A
Santa Clara, California 95052.